Bridge, Pontoon, at Nebraska City, ... 339
Steel on the Northern Pacific Railroad, Note on a Danger to, ... 340
Broader Field, A, for the United States Geological Survey. (Frazer), ... 208
Bronze of Japanese Magic Mirrors, Composition of, ... 500
Brown, Allan D. The Electrical Distribution of Time, ... 14

Calorimeter, A New. (Peabody), ... 134
Canal, Nicaragua, The, ... 340
Panama, The. (*Engineering News*), ... 341
Car Heater, Safety, Description of a. (Bache), ... 145
The Bache, Report of Committee on Science and the Arts, on, 143
Carbutt, John. A Perfect Substitute for Glass as a Support for Gelatine Bromide of Silver for Use in Photography, ... 478
Cast Iron, Influence of Aluminium upon. (Keep, Mabery and Vorce), ... 220
Chance, Alex. M. Recovery of Sulphur from Alkali Waste, by Means of Lime-Kiln Gases, ... 261
Chlorine, Manufacture of, The Weldon-Pechiney Process for. (Dewar), . . . 420
Chlorophyl, Animal. (MacMunn), ... 497
Clamer's Process of Cleansing and Coating Metal Surfaces, Report of the Committee on Science and the Arts, on, ... 73
Coincidences, Astronomical, Two Remarkable. (D'Auria), ... 295
Correspondence—C., L. E. National Public Works, ... 244
Reply to Capt. Turtle. (Haupt), ... 140
Photographs of Lightning. (Jennings), ... 491
Improvement of Sabine Pass. (Turtle), ... 137, 246
Crafts, J. M. Action of Mercury on Platinum, ... 419
Purification of Mercury, ... 416
Cupolas for Melting Pig Iron, Construction of Various Kinds of. (Gouvy), . . 425
Cutch and Gambier. (Trimble), ... 417
Cylinders for Successive Expansion Engines, To Determine the Sizes of. (Gow), 258

D'Auria, L. Two Remarkable Astronomical Coincidences, ... 295
Decline of Engineering, The. (Le Van), ... 25
Delaware River, Removal of Islands in, ... 339
Dewar, J. The Weldon-Pechiney Process for the Manufacture of Chlorine, . . 420
Dougherty Railroad Signal, The Report of the Committee on Science and the Arts, on, ... 335
Dudley, Chas. B. Fuel Oil, ... 81
Durfee, W. F. (*Gouvy.*) Construction of Various Kinds of Cupolas for Melting Pig Iron, ... 425

Electric Furnaces, Early Forms of. (Houston), ... 64, 215
Electric Welding. (Thomson), ... 399
(Woodbury), ... 471
Electrical Distribution of Time, The. (Brown), ... 14
Electricity, Protection of Buildings against Water Overflows by. (Weil), . . . 330
Electro-Chemical Actinometer, An. (Gouy and Rigollet), ... 416
Elevated Road, Philadelphia, The Reading Terminal, ... 496
Engineering, Decline of, The. (Le Van), ... 25

Engines, Distribution of Internal Friction in. (Thurston), ... 370
Successive Expansion, To Determine the Sizes of Cylinders for. (Gow), 258
Vibrating. Lidback, ... 337
Exposures, Instantaneous, Photographic, Determining Absolute Time of. (Levison), ... 162
Eye, Photograph of the Human, by Magnesium Flash Light. (Reymond), . . 162

Films, Insoluble Gelatine in Emulsion Photography. (Stieglitz), ... 162
Food, Detection of Commercial Saccharin in. (Bornstein), ... 416
FRANKLIN INSTITUTE—Committee on Science and the Arts. Report on the Bache Safety Car Heater, ... 143
Committee on Science and the Arts. Report on Clamer's Process of Cleansing and Coating Metal Surfaces, . . . 73
Committee of Science and the Arts. Report on the Dougherty Railroad Signal, ... 335
Committee on Science and the Arts. Report on the Hyatt Pure Water System, ... 71
Committee on Science and the Arts. Report on Lance's Method of Utilizing Oil-Cloth Waste, ... 334
Committee on Science and the Arts. Report on the Simond's Universal Metal Rolling Machine, ... 345
Committee on Science and the Arts. Report on Ziegler's Patent Trestle and Scaffold System, ... 149
Gifts to the Library, ... 164, 262, 342, 420, 502
Proceedings of the Stated Meetings, June to November, 1888, ... 168, 344, 423, 504
Frazer, Persifor. A Broader Field for the U. S. Geological Survey, ... 208
Obituary Notice of H. C. Lewis, ... 154
of Rachel L. Bodley, ... 69
Friction, Internal, of Engines, Distribution of. (Thurston), ... 370
Fuel Oil. (Dudley), ... 81
Furnaces, Electric, Early Forms of. (Houston), ... 64, 215

Gambier and Cutch. (Trimble), ... 417
Gelatine Bromide of Silver, A Substitute for Glass as a Support for Use in Photography. (Carbutt), ... 478
Gelatine Films, Insoluble, as a Substitute for Glass in Emulsion Photography, (Stieglitz), ... 162
Geographical Congress, International, in Paris, ... 163
Geological Survey, U. S., A Broader Field for the. (Frazer), ... 208
Gieseler, E. A. Standard Measures, ... 115
Girder, Continuous, Indeterminate Multipliers for the. (Lindenberger), ... 465
Girders, Jointed Bow, General Theory of. (Werner), ... 53, 232, 317
Glass as a Support for Gelatine Bromide of Silver, A Substitute for. Use in Photography. (Carbutt), ... 478
Glass, Insoluble Gelatine Films as a Substitute for, in Emulsion Photography. (Stieglitz), ... 162
Gouvy, M. A. An Investigation of the Construction of Various Kinds of Cupolas for Melting Pig Iron, ... 425

Gouy and H. Rigollet. An Electro-Chemical Actinometer, ... 416
Gow, John L. The Zeuner Valve Diagram, ... 255
To determine the Sizes of Cylinders for Successive Expansion Engines, ... 258
Gump, W. E. The Writing Telegraph, ... 297

Haupt, Lewis M. Feasibility of Underground Railroads in Philadelphia, . . . 448
Reply to Capt. Turtle's Communication on the Sabine Pass, . 140
Hazen, H. Allen. Movement of Upper Air Currents, ... 45
Heater, Safety Car, Bache, Report of Committee on Science and the Arts, on, . 143
Description of a. (Bache), ... 145
Helme, William, Obituary Notice of, ... 155
Henderson, Hanford. Aluminium, ... 273
Houston, Edwin J. On Some Early Forms of Electric Furnaces, ... 64, 215
Hyatt Pure Water System, Report of the Committee on Science and the Arts, on, 71
Hydrogen Iodide, Preparation of. (Meyer), ... 260

Indigo in China, Production of, ... 502
International Congress of Geologists. Note to Libraries and Individuals, . . . 80
Geographical Congress in Paris, ... 163
Iron Ores of the United States, The. (Birkinbine), ... 190
Isherwood, B. F. (Pictet.) Determination of a Definition of Temperature, . . 212

Japanese Magic Mirrors, Composition of the Bronze of, ... 500
Jennings, W. N. Photographs of Lightning, ... 491

Keep, W. J., C. F. Mabery and L. D. Vorce. The Influence of Aluminium upon Cast Iron, ... 220
Kent, Wm. Weighing Machines, ... 169

Lance's Method of Utilizing Oil-Cloth Waste, Report of the Committee on Science and the Arts, on, ... 334
Landslide, Danger to a Bridge on the Northern Pacific Railroad from, ... 340
Le Van, Wm. B. Is Engineering on the Decline? 25
Levison, W. G. Determining the Absolute Time of Instantaneous Photographic Exposures, ... 162
Lewis, Henry Carvill, Obituary Notice. (Frazer), ... 154
Lidback's Vibrating Engine, ... 337
Lightning, Photographs of. (Jennings), ... 491
Lindenberger, C. H. Indeterminate Multipliers for the Continuous Girder, . . 465
Lustre, Metallic, Cause of. (Spring), ... 419

Mabery, C. F. See Keep, W. J., ... 220
MacMunn, C. A. Animal Chlorophyl, ... 497
Magic Mirrors, Japanese, Composition of Bronze of, ... 500
Magnesium Flash Light, Photograph of the Eye, by, ... 162
Powder for Photographic Purposes, ... 162
Mason, Geo. C., Jr. Memoir of Thomas Ustick Walter, ... 404
Measures, Standard. (Gieseler), ... 115

Mercury, Action of, on Platinum. (Crafts), ... 419
Purification of. (Crafts), ... 416
Menocal, A. G. The Nicaragua Canal, ... 340
Metal Rolling Machine, The Simonds', Report of the Committee on Science and the Arts, on, ... 345
Metal Rolling Machine, The Simonds', ... 1
Surfaces, Cleansing and Coating, The Ajax Metal Company's Process of, Report of the Committee on Science and the Arts, on, ... 73
Metallic Lustre, Cause of. (Spring), ... 419
Meyer, Lothar. Preparation of Pure Hydrogen Iodide, ... 260
Victor. Preparation and Properties of Nitrogen Chloride, ... 498
Mirrors, Japanese Magic, Composition of the Bronze of, ... 500
Movement of Upper Air Currents. (Hazen), ... 45

National Public Works, ... 157, 244
Nicaragua Canal, The, ... 340
Nitrogen Chloride, Preparation and Properties of. (Meyer), ... 498
Note to Libraries and Individuals. (International Congress of Geologists), . . 80

Obituary. Rachel L. Bodley, ... 69
James Curtis Booth, ... 67
William Helme, ... 155
Henry Carvill Lewis, ... 154
Thomas U. Walter, ... 404
Joseph Zentmayer, ... 483
Oil-Cloth Waste, Lance's Method of Using, Report of the Committee on Science and the Arts, on, ... 334
Oil, Fuel. (Dudley), ... 81

Panama Canal, The. (*Engineering News*), ... 341
Paris Universal Exposition, 1889, ... 500
Peabody, Cecil H. A New Calorimeter, ... 134
Pemberton, H., Jr. An Inquiry into the Relative Value of Aluminium and its Alloys to the Arts, ... 265, 369
Pennsylvania State Weather Service. Monthly Weather Review. May to October, 1888. (*Supplement*, July to December.)
Petroleum "Sludge" Acid, Utilization of. (Thompson), ... 260
Philadelphia, Port of, Removal of Islands in, ... 339
Underground Railroads in, Feasibility of. (Haupt), ... 448
Photographic Exposures, Instantaneous, Determining Absolute Time of. (Levison), ... 162
Photographs of Lightning. (Jennings), ... 491
Photographs of the Eye by the Magnesium Flash Light. (Reymond), ... 162
Photography, Emulsion, Insoluble Gelatine Films as a Substitute for Glass in. (Stieglitz), ... 162
Photography, A Substitute for Glass as a Support for Gelatine Bromide of Silver for Use in. (Carbutt), ... 478
Pig Iron, Cupolas for Melting, Construction of Various Kinds of. (Gouvy), . . 425

Pictet, Raoul. Theoretical and Experimental Determination of a Definition of Temperature, ... 212
Platinum, Action of Mercury on. (Crafts), ... 419
Pontoon Bridge at Nebraska City, The, ... 339
Protection of Buildings Against Water Overflows by Electricity. (Weil), . . . 330
Public Civil Works, Reorganization of, ... 161
Works, National, ... 157, 244
Pure Water System, Hyatt, Report of the Committee on Science and the Arts, on, 71
Purification of Mercury. (Crafts), ... 416

Quercitrin and Rutin, Supposed Identity of. (Schunk), ... 262

Railroad Signal, The Dougherty, Report of the Committee on Science and the Arts, on, ... 335
Rails in Active Service, Protection of, from Rust. (Spring), ... 417
Reading Railroad Terminal, The, ... 496
Reorganization of Public Civil Works, ... 161
Reymond, DuBois. Photograph of the Eye by the Magnesium Flash Light, . . 162
Richards, Mrs. R. H. Sanitary Science in the Home, ... 95
Rigollet and Gouy. An Electro-Chemical Actinometer, ... 416
Rolling Machine, Simonds'. Report of the Committee on Science and the Arts on, 345
Metal, The Simonds, ... 1
Rust, Protection of Rails in Active Service from. (Spring), ... 417
Rutin and Quercitrin, Supposed Identity of. (Schunk), ... 262

Sabine Pass, Improvement of. (Turtle), ... 137, 246
Reply to Capt. Turtle's Communication on. (Haupt), ... 140
Saccharin, Commercial, Detection of, in Food. (Bornstein), ... 416
Sanitary Science in the Home. (Richards), ... 95
Scaffold System, Trestle and, Ziegler's, Report of the Committee on Science and the Arts, on, ... 149
Schunk, E. The Supposed Identity of Rutin and Quercitrin, ... 262
Silicon, Preparing, A New Method of. (Warren), ... 498
Simonds, Geo. F. Universal Metal Rolling Machine, ... 1, 345
"Sludge" Acid, Petroleum, Utilization of. (Thompson), ... 260
Smith's and Windmill Islands, Philadelphia, Removal of, ... 339
Spring, W. Cause of Metallic Lustre, ... 419
Protection from Rust of Railroad Rails in Active Service, ... 417
Standard Measures. (Gieseler), ... 115
Steam, Efficiency of, at High Pressures. (Beauman), ... 495
Stieglitz, A. Insoluble Gelatine Films as a Substitute for Glass in Photography, 162
Sulphur, Recovery of, from Alkali Waste. (Chance), ... 261

Telegraph, Writing, The. (Gump), ... 297
Temperature, Definition of, Determination of, etc. (Pictet), ... 212
Thompson, W. P. Utilization of Petroleum "Sludge" Acid, ... 260
Thomson, Elihu. Electric Welding, ... 399
Thurston, Robert H. Distribution of Internal Friction of Engines, ... 370
Time, Electrical Distribution of. (Brown), ... 14

Trestle and Scaffold System, Zeigler's, Report of the Committee on Science and the Arts, on, ... 149
Trimble, H. Cutch and Gambier, ... 417
Turtle, Thomas. Improvement of Sabine Pass, ... 137, 246

Underground Railroads in Philadelphia, Feasibility of. (Haupt), ... 448
United States Geological Survey, A Broader Field for. (Frazer), ... 208
United States, Iron Ores of. (Birkinbine), ... 190

Valve Diagram, The Zeuner. (Gow), ... 255
Vibrating Engine. (Lidback), ... 337
Vorce, L. D. See Keep, W. J., ... 220

Walter, Thomas Ustick, Memoir of. (Mason, Jr.), ... 404
Warren, H. W. A New Method of Preparing Silicon, ... 498
Water Overflows, Protection of Buildings Against. (Weil), ... 330
Water, Pure, The Hyatt System of. Report of the Committee on Science and the Arts, on, ... 71
Watt's Electric Furnaces. (Houston), ... 215
Weather Review, North Pennsylvania State Weather Service. May to October, 1888. *Supplements*, August to December.
Weighing Machines. (Kent), ... 169
Weil, Leopold. Protection of Buildings against Water Overflows, by Elecricity, . 330
Welding, Electric. (Thomson), ... 399
(Woodbury), ... 471
Weldon-Pechiney Process for the Manufacture of Chlorine, The. (Dewar), . . 420
Werdermann's Electric Furnaces. (Houston), ... 64
Werner, E. A. General Theory of Jointed Bow Girders, ... 53, 232, 317
Windmill and Smith's Islands, Philadelphia, Removal of, ... 339
Woodbury, C. J. H. Electric Welding, ... 471
Writing Telegraph, The. (Gump), ... 297

Zentmayer, Joseph, Memoir of, ... 483
Zeuner Valve Diagram, The. (Gow), ... 255
Ziegler's Patent Trestle and Scaffold System, Report of the Committee on Science and the Arts, on, ... 149

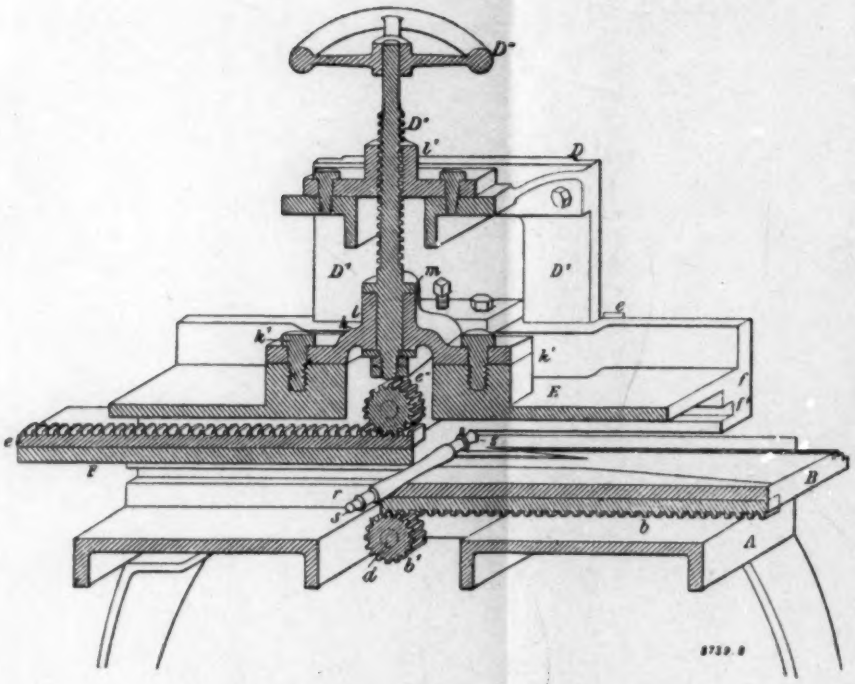
D''
D'
l'
D
D'
m
D'
k'
k
e
k'
E
f
f'
e'
c
b
B
r
s
A
d
b'
8739.B

FIG. 9.

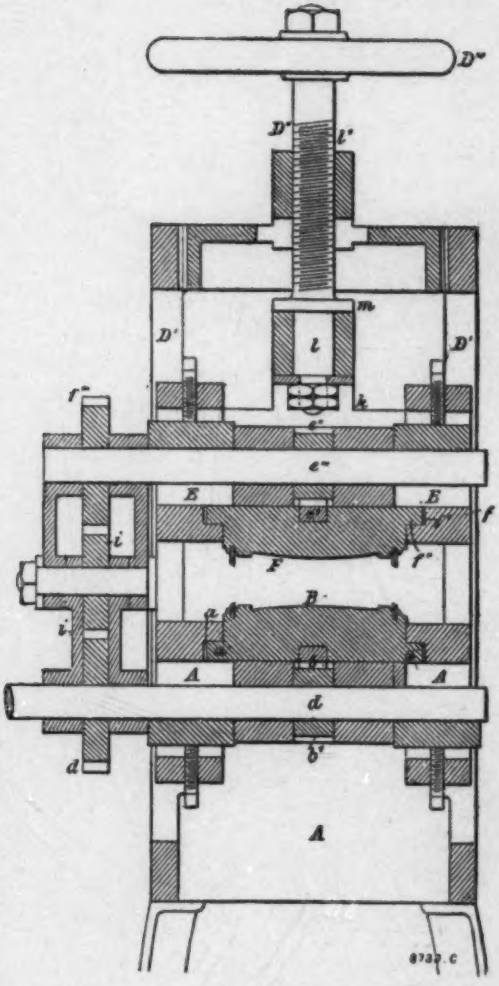
D''
D'
l'
m
D'
l
D'
k
f''
e''
e'''
E
E
f
f''
F
i
B
a
i
A
A
d
b'
d
A
8732.C

FIG. 10.

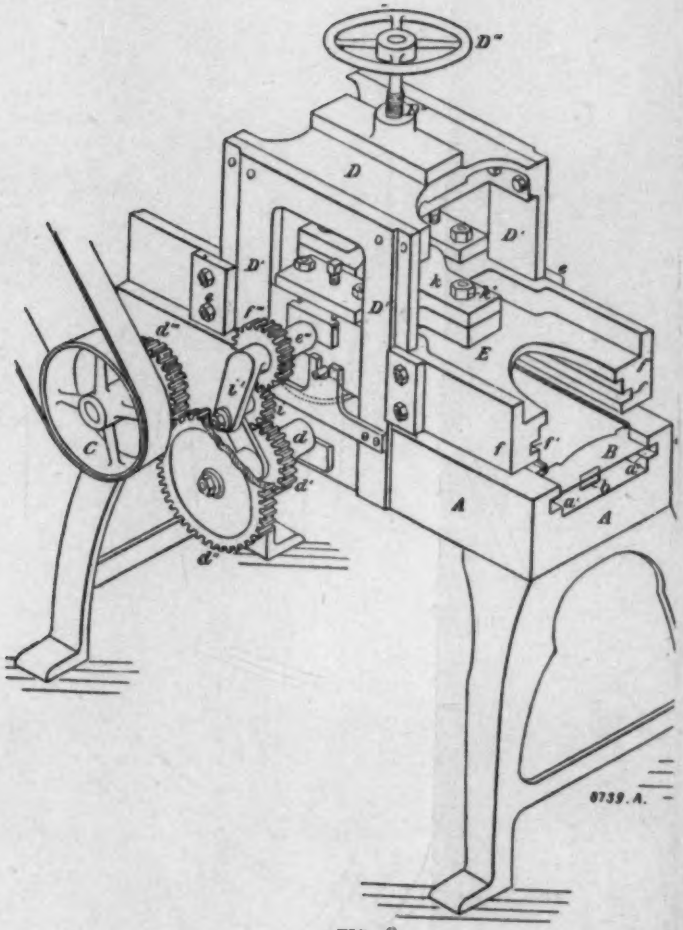

FIG. 8.

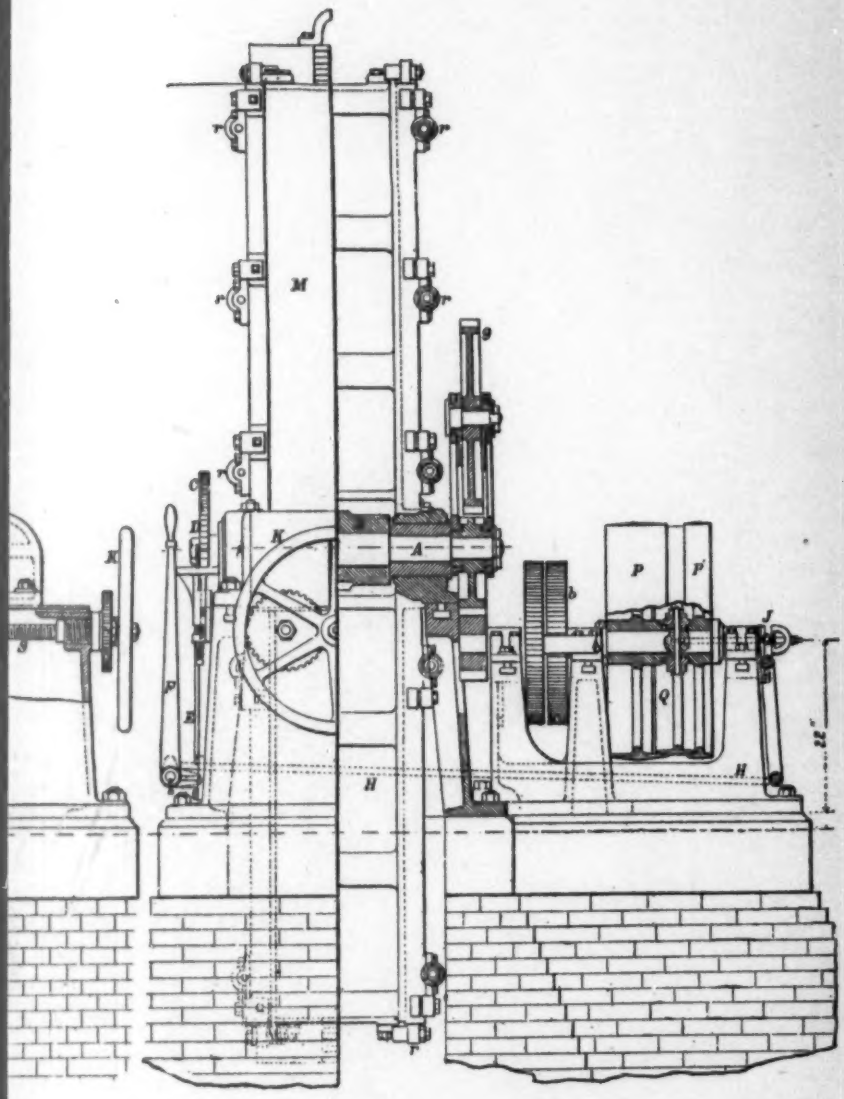

FIG. 13.

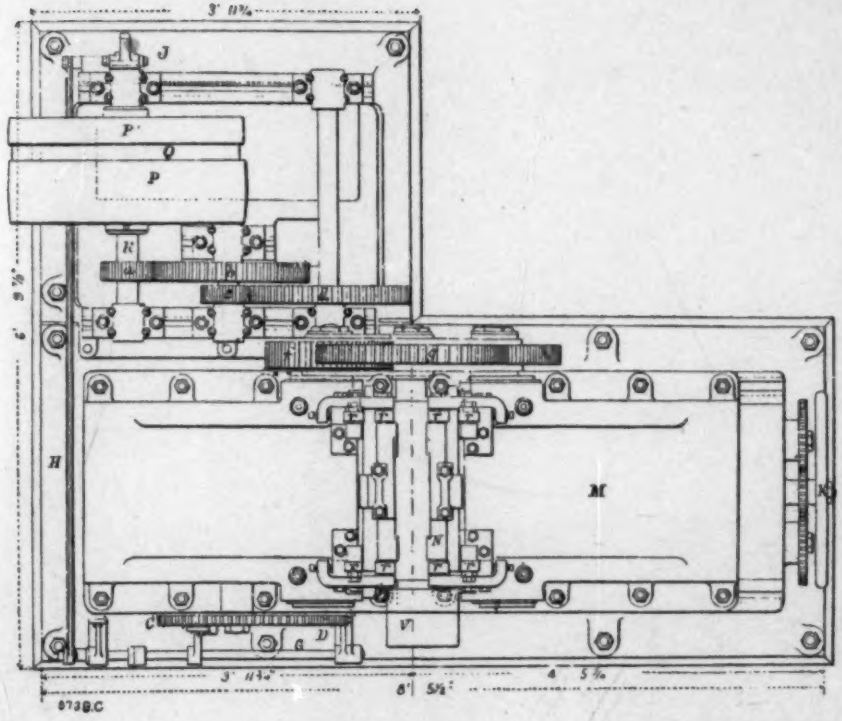

FIG. 14.

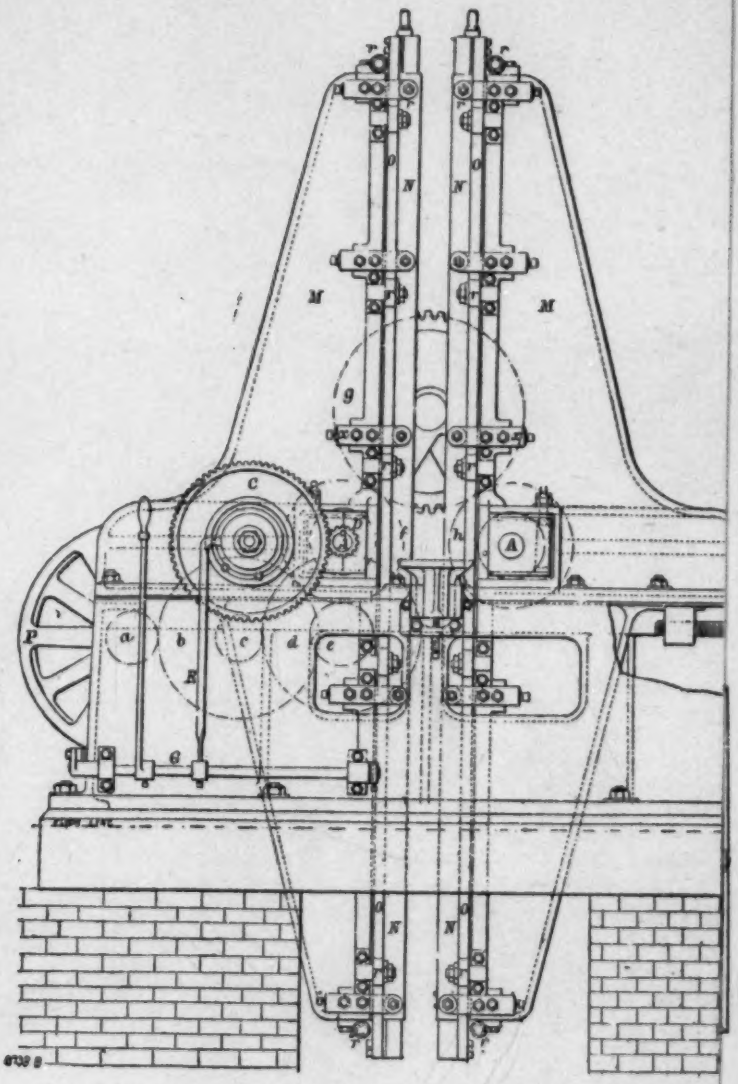

FIG. 12.

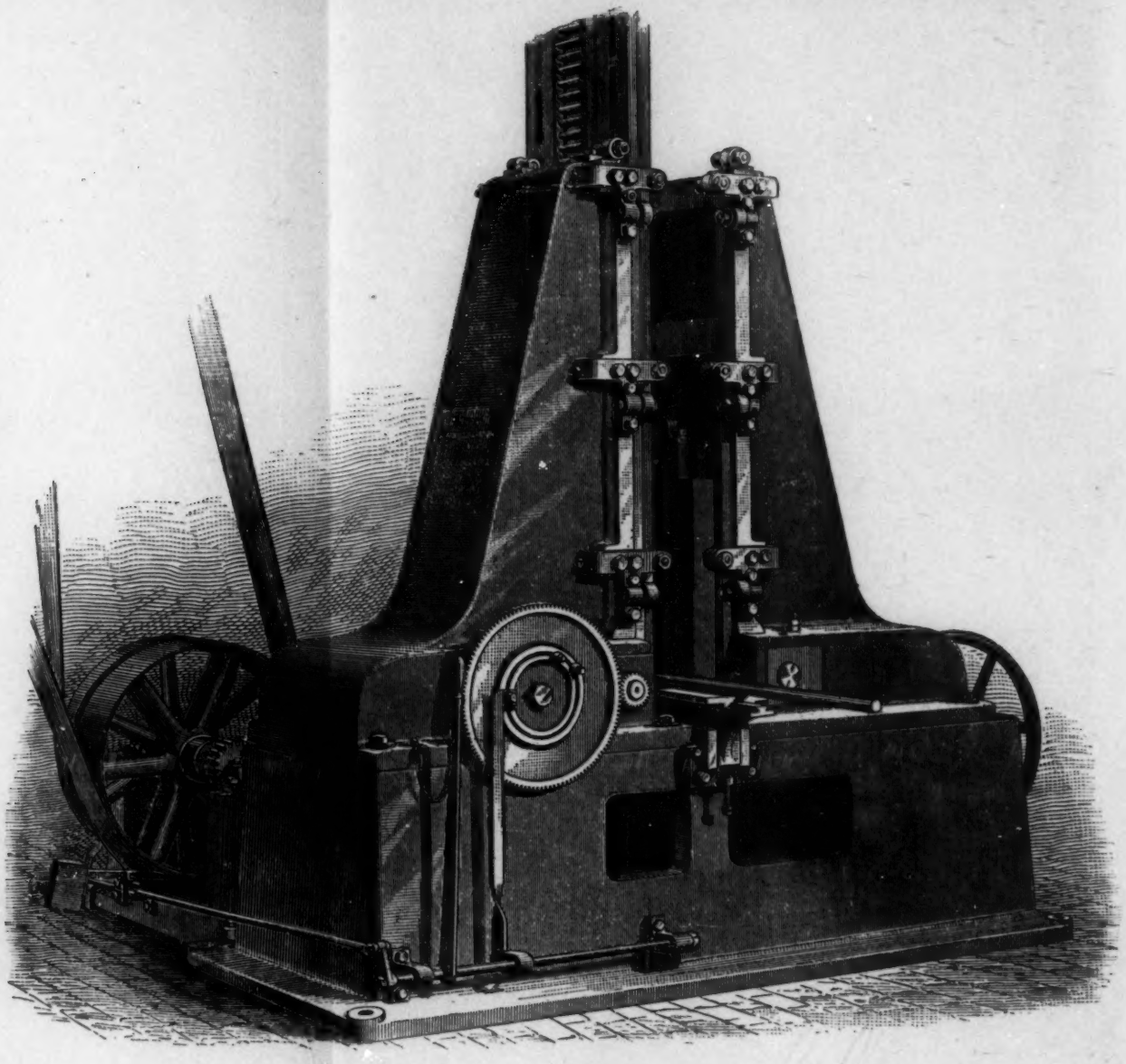

FIG. II.